Thompson Brook

Watershed Summary

Watershed Description and Maps

The Thompson Brook watershed covers an area of approximately 3,010 acres in the mid-northern half of Connecticut, west of the Connecticut River (Figure 1). The watershed is located in the Town of Avon, CT.

The Thompson Brook watershed includes one segment impaired for recreation due to elevated bacteria levels. This segment was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) List of Impaired Waters. Table 1 shows Thompson Brook (Segment 2) (CT4316-00_02) as unassessed for recreation, but its impaired status was determined by CT DEEP from 2010 data and will be listed as impaired on the 2012 303(d) List of Impaired Waters. The other segment (CT4316-00_01) in the watershed is not supporting designated uses for recreation as of the writing of this document, but may not be included in the 2012 303(d) List of Impaired Waters following assessment of 2010 data from CT DEEP. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of other waterbodies in the watershed (CTDEEP, 2010).

The impaired segment addressed in this TMDL is Thompson Brook (CT4316-00_02). Thompson Brook is within a watershed that encompasses Big Brook and Chidsey Brook (Figure 2). Thompson Brook begins at the confluence of Big Brook and Chidsey Brook just upstream of Thompson Road crossing and east of Route 167 in Avon, flows through Beaverdam Pond, and ends at the confluence with the Farmington River just downstream of Old Farms Road crossing in Avon. The bacteria impaired segment (CT4316-00_02) consists of 1.24 miles of the river in Avon (Figure 2). This impaired segment of Thompson Brook begins at the confluence of Big Brook and Chidsey Brook just upstream of Thompson Road crossing in Avon, flows easterly, and ends at the inlet to Beaverdam Pond just downstream of the old Rail Road crossing in Avon.

Impaired Segment Facts

Impaired Segment: Thompson Brook (CT4316-00_02)

Towns: Avon

Impaired Segment Length (miles): 1.24

Water Quality Classification: Class A

Designated Use Impairment: Recreation

Sub-regional Basin Name and Code: Thompson Brook, 4316

Regional Basin: Farmington

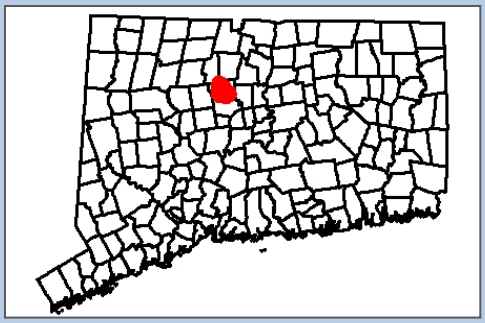
Major Basin: Connecticut

Watershed Area (acres): 3,010

MS4 Applicable? Yes

Applicable Season: Recreation Season (May 1 to September 30)

Figure 1: Watershed location in Connecticut



The impaired segment of Thompson Brook has a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. As there are no designated beaches in this segment of Thompson Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Table 1: Impaired segment and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT4316-00_01	Thompson Brook (Avon)-01	From mouth at confluence with Farmington River (DS of Old Farms Road crossing), US to inlet of Beaverdam Pond (DS of old Rail Road crossing - now a bike path), Avon.	1.91	FULL	NOT	FULL
CT4316-00_02	Thompson Brook (Avon)-02	From inlet to Beaverdam Pond (DS of old Rail Road crossing), US to HW at confluence of Big Brook and Chidsey Brook (just US of Thompson Road crossing), Avon.	1.24	U	U*	FULL

Shaded cells indicate impaired segment addressed in this TMDL

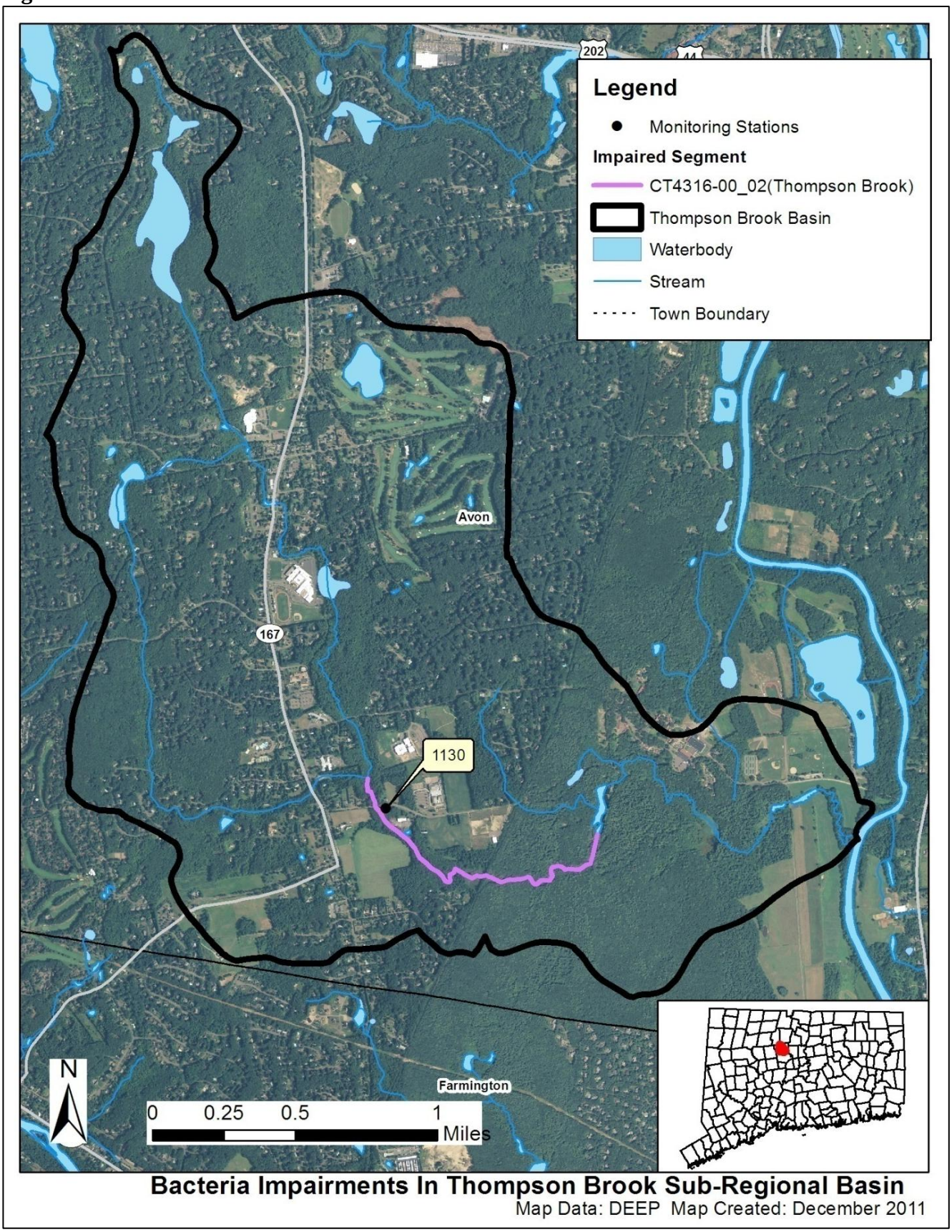
***Impairment determined from 2010 data; will be listed as impaired on the 2012 303(d) List of Impaired Waters**

FULL = Designated Use Fully Supported

NOT = Designated Use Not Supported

U = Unassessed

Figure 2: GIS map featuring general information of the Thompson Brook watershed at the sub-regional level



Land Use

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from nutrients and bacteria from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 3 and 4, the Thompson Brook watershed consists of 52% forest, 38% urban, 6% agriculture, and 4% water land uses. Upstream of the impaired segment of Thompson Brook, Big Brook and Chidsey Brook flow through dense residential development with some mixed forested areas, including Red Mountain Lane Open Space, Juniper Road Open Space, and Horseguard State Park Scenic Reserve. Route 167 cuts through the middle of the watershed and is surrounded by commercial development. Chidsey Brook passes to the west of a large golf course, the Golf of Avon, and to the east of Avon High School, which has a large parking lot and recreation field. The headwaters of the impaired segment of Thompson Brook begin just west of Pine Grove School and Scoville Park, both large open spaces with parking lots. Both sides of the upper half of the impaired segment are characterized by large agricultural hayfields, while the lower half flows into a large mixed forested area before reaching the buffered Beaverdam Pond in Avon, CT.

Figure 3: Land use within the Thompson Brook watershed

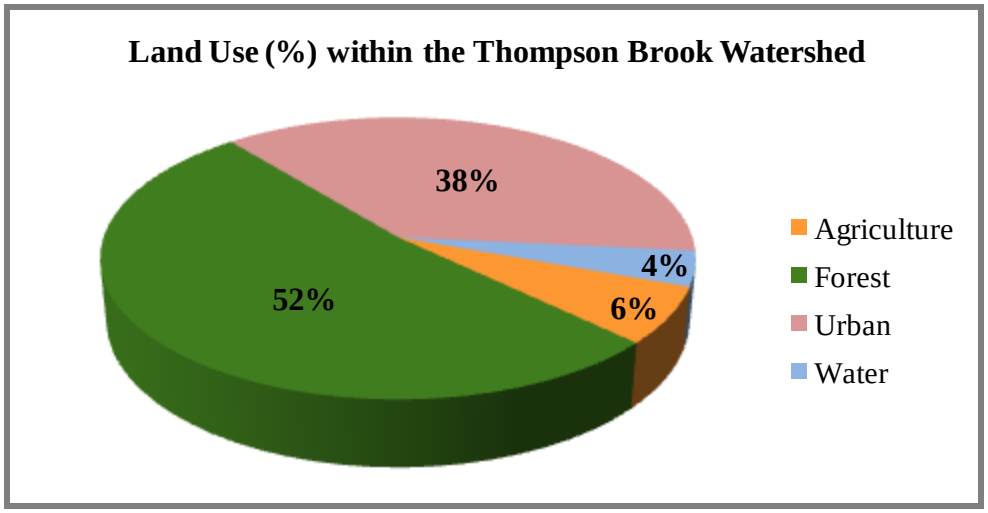
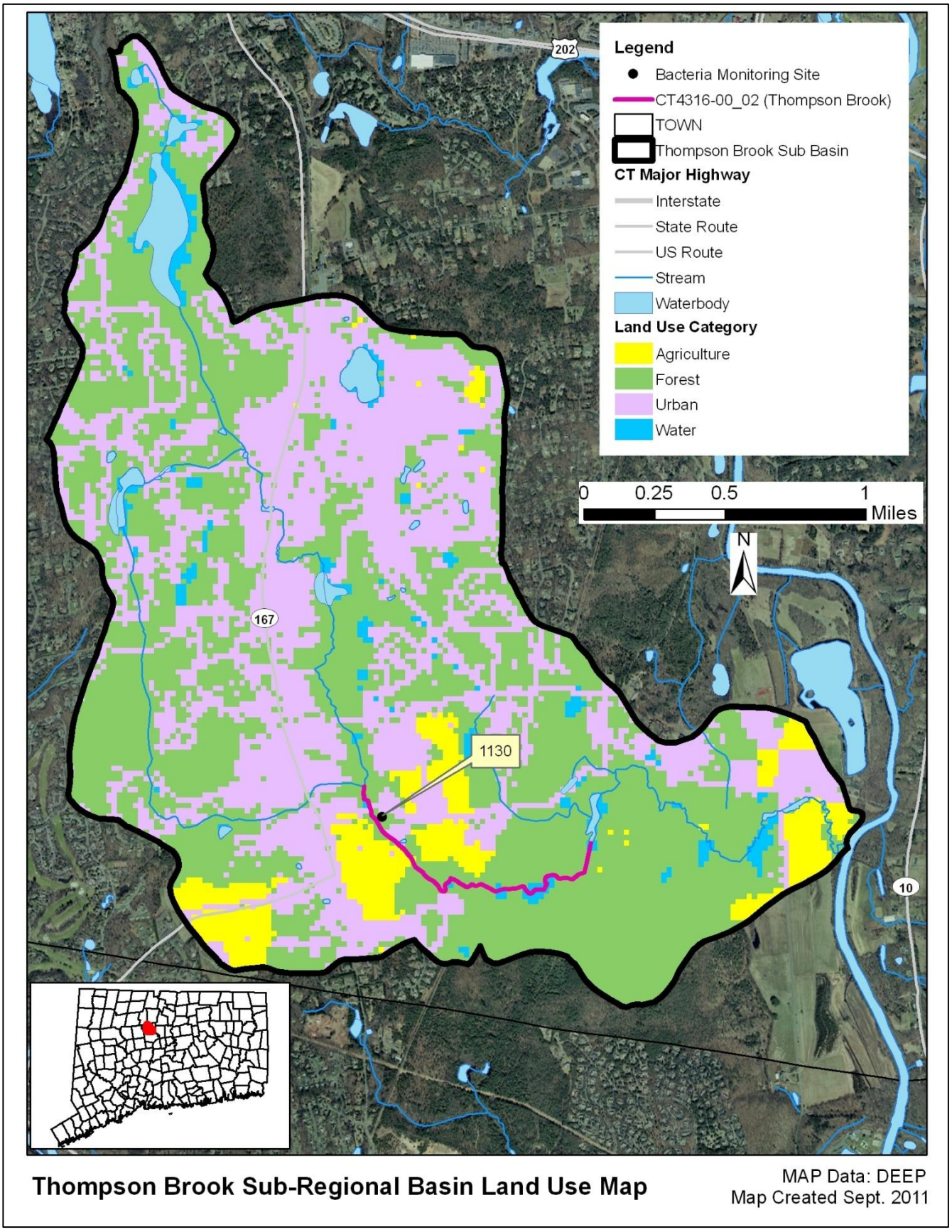


Figure 4: GIS map featuring land use for the Thompson Brook watershed at the sub-regional level



WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for impaired segments in the Thompson Brook watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT4316-00_02	Thompson Brook	1130	Thompson Road	Avon	41.771667	-72.856389

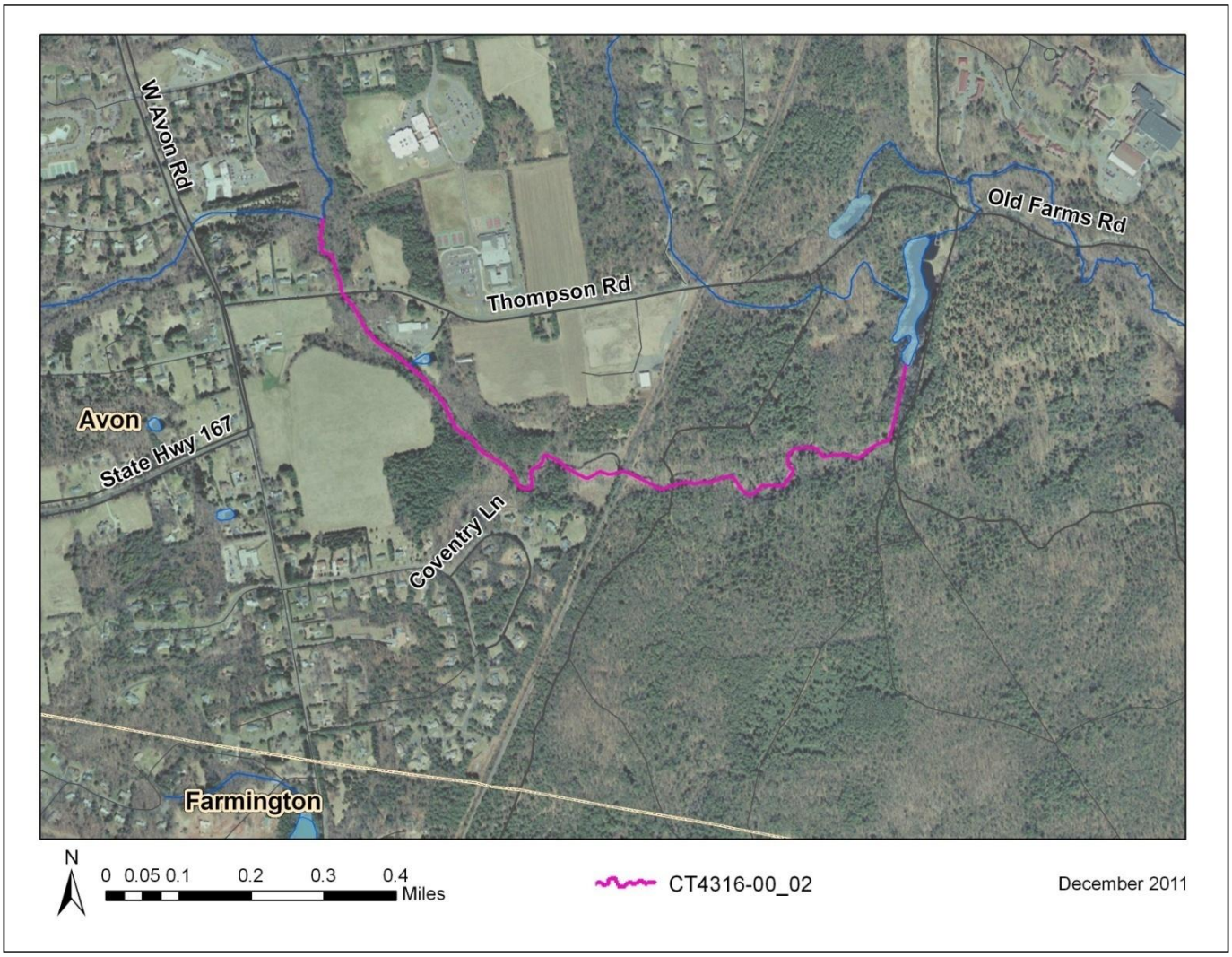
Thompson Brook (CT4316-00_02) is a Class A freshwater river (Figure 5). Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location in 1998, 2000, 2001, 2008, and 2009 (Station 1130) (Table 2).

The water quality criteria for *E. coli*, along with bacteria sampling results for Station 1130 in 1998, 2000, 2001, 2008, and 2009, are presented in Table 8. The annual geometric mean was calculated for Station 1130 and exceeded the WQS for *E. coli* in 2008. Single sample values at this station exceeded the WQS for *E. coli* multiple times in 2008. Bacteria sampling results for Station 1130 in 1998, 2000, 2001, and 2009 did not exceed the WQS for *E. coli* for geometric mean or single sample values.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for each station for wet-weather and dry-weather sampling days, where possible (Table 8). For the impaired segment of Thompson Brook, only the geometric mean during wet-weather at Station 1130 exceeded the WQS for *E. coli*.

Due to the elevated bacteria measurements presented in Table 8, this segment of Thompson Brook did not meet CT's bacteria WQS, was identified as impaired, and was placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

Figure 5: Aerial map of Thompson Brook



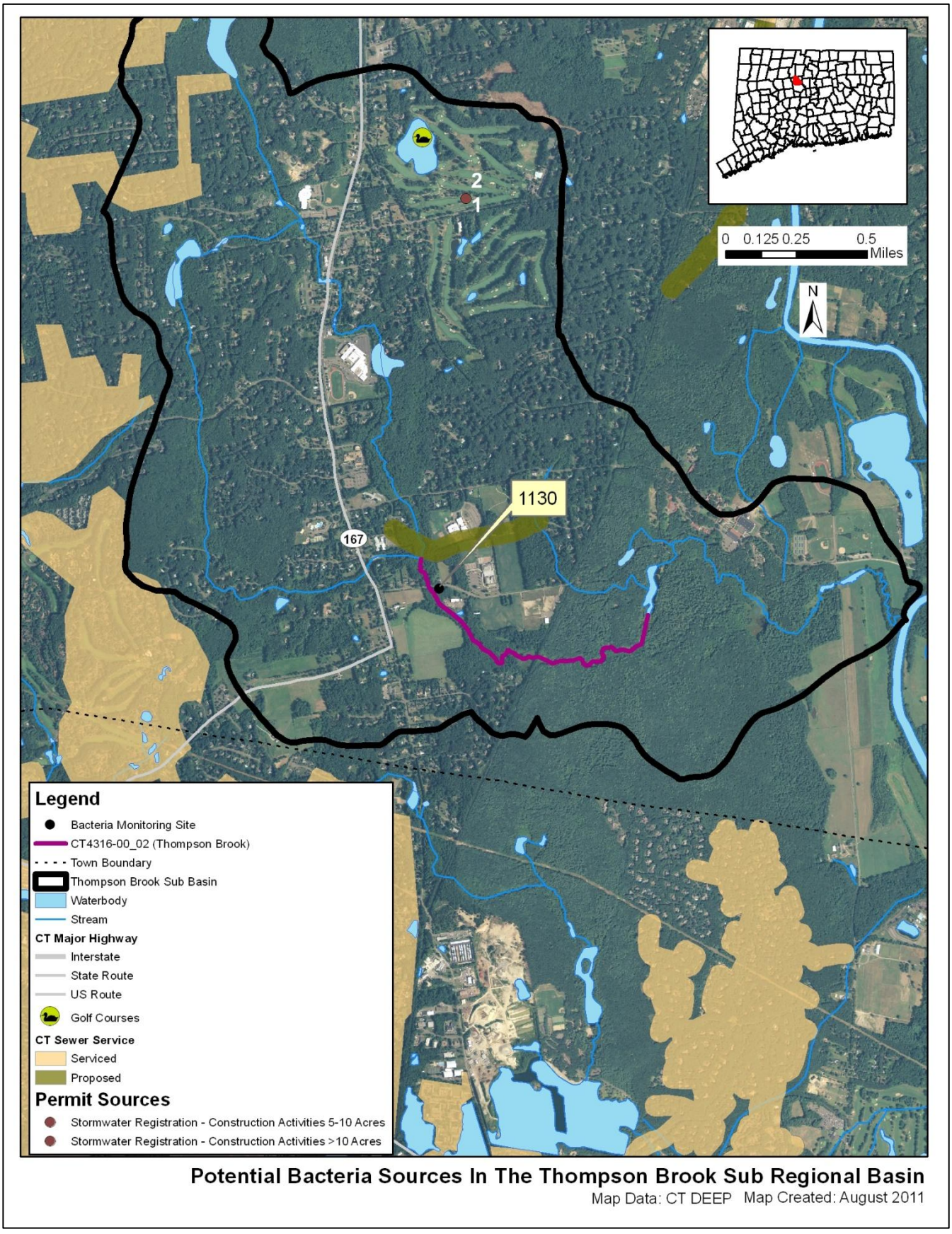
POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the watershed based on land use (Figures 3 and 4) and a collection of local information for the impaired waterbody is presented in Table 3 and Figure 6. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not suggest that there are no potential issues on this segment, but indicates a lack of current data to evaluate the segment as part of the assessment process. For some segments, there are data from permitted sources, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Thompson Brook watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Thompson Brook CT4316-00_02	**x**	**x**		**x**	**x**	**x**	**x**	

Figure 6: Potential sources in the Thompson Brook watershed at the sub-regional level



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring may reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	0
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	0
GSI	Stormwater Associated with Industrial Activity	0
GSM	Part B Municipal Stormwater MS4	1
GSN	Stormwater Registration – Construction	2
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Thompson Brook watershed. Bacteria data are currently not available for any of the permitted discharges in the watershed. Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Thompson Brook watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Avon	Town of Avon	GSM000044	Part B Municipal Stormwater MS4	Avon, Town of	N/A
Avon	State Of Connecticut Department Of Transportation	GSN001810	Stormwater Registration - Construction Activities >10 Acres	Project No. 4-123	1
Avon	State Of Connecticut Department Of Transportation	GSN001748	Stormwater Registration - Construction Activities 5-10 Acres	State Project No. 04-128	2

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

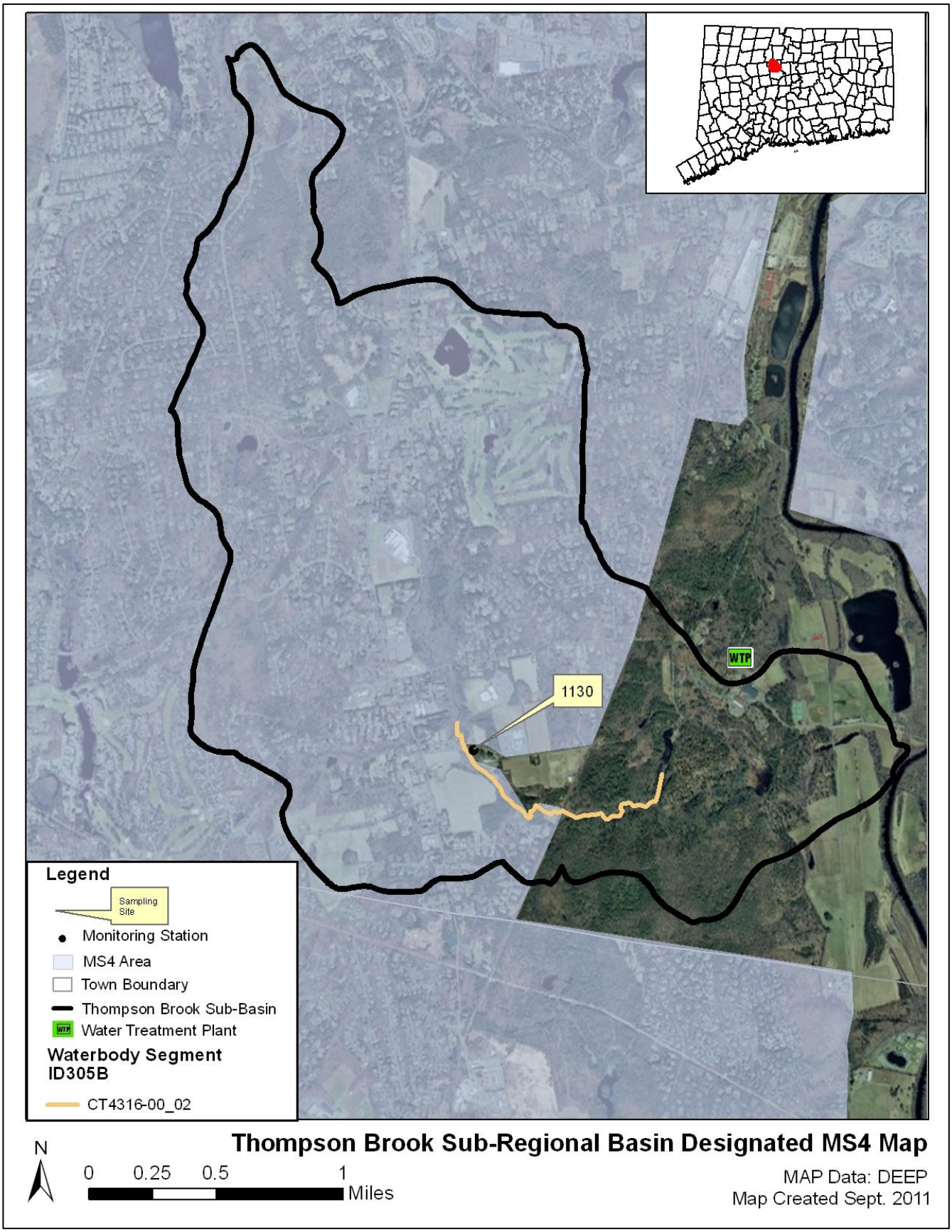
While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segment of the Thompson Brook watershed is located within the Town of Avon, CT. The town is largely urbanized, as defined by the U.S. Census Bureau, and is required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figure 7). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants and protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Figure 7: MS4 areas of the Thompson Brook watershed



Publicly Owned Treatment Works

As shown in Figure 7, there are no publicly owned treatment works (POTWs), or wastewater treatment plants, in the Thompson Brook watershed, and therefore, POTWs are not a potential source of loading to the impaired segment of Thompson Brook.

Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). Potential sources of NPS within the Thompson Brook watershed are described below.

Stormwater Runoff from Developed Areas

Approximately 38% of the land use in the watershed is considered urban, and the impaired segment is located downstream of the densely populated upper half of the watershed, particularly along Route 167 (Figures 4 and 9). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000).

The impervious cover shown in Figures 8 and 9 is not necessarily reflective of the commercial and residential development upstream of the impaired segment. Several large development complexes, including Avon High School, Valley Community Baptist Church, and Pine Grove School, may have direct stormwater runoff effect on the impaired segment of Thompson Brook. Water quality data taken at Station 1130 exceeded the geometric mean during wet-weather, which suggests that stormwater runoff may be a source of bacteria to Thompson Brook.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Thompson Brook watershed represent another potential source of bacteria. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001). As the majority of lower half of the watershed is undeveloped, wildlife waste is a potential source of bacteria to Thompson Brook. However, much of the residential development in the watershed is located upstream of the impaired segment of Thompson Brook. As such, waste from domestic animals, such as dogs, may also be contributing to bacteria concentrations in the Thompson Brook watershed.

Golf of Avon is located within the Thompson Brook watershed upstream of the impaired segment, and several recreational fields at Avon High School and Pine Grove School are located adjacent to the impaired segment of Thompson Brook (Figure 6). Geese and other waterfowl are known to congregate in open areas including recreational fields, agricultural crop fields, and golf courses. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of the State. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). This runoff can include pollutants from farm practices such as storing manure, allowing livestock to wade in nearby waterbodies, applying fertilizer, and reducing the width of vegetated buffer along the shoreline. Agricultural land use makes up 6% of the Thompson Brook watershed. The largest agricultural hayfields are located immediately adjacent to the upper half of the impaired segment, and may be contributing directly to bacterial contamination.

Figure 8: Range of impervious cover (%) in the Thompson Brook watershed

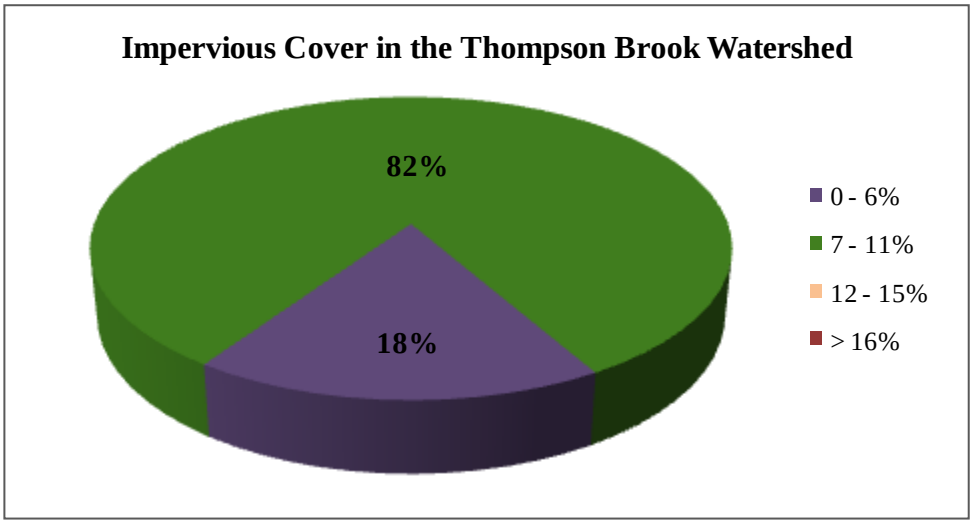
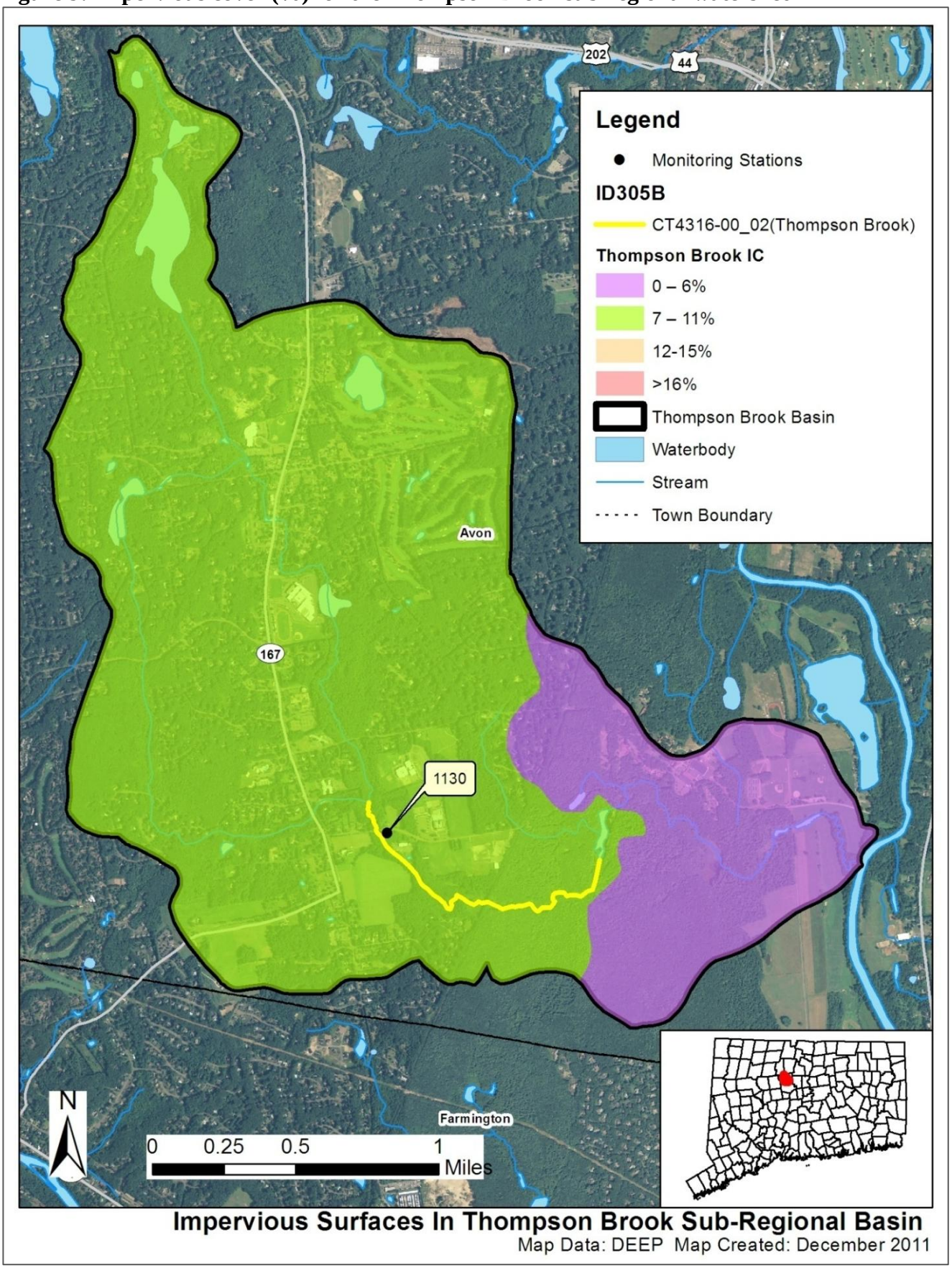


Figure 9: Impervious cover (%) for the Thompson Brook sub-regional watershed



Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, the majority of the watershed relies on onsite wastewater treatment systems, such as septic systems. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Town of Avon is part of the Farmington Valley Health District (http://www.fvhd.org/).

As shown in Figure 6, only a residential area in the upper reaches of the watershed relies on the municipal sewer system; however, there are proposed sewer connections for Avon High School and Pine Grove School directly upstream of the impaired segment of Thompson Brook. Sewer system leaks and other illicit discharges or connections can contribute bacteria to nearby surface waters.

Additional Sources

There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in Thompson Brook. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

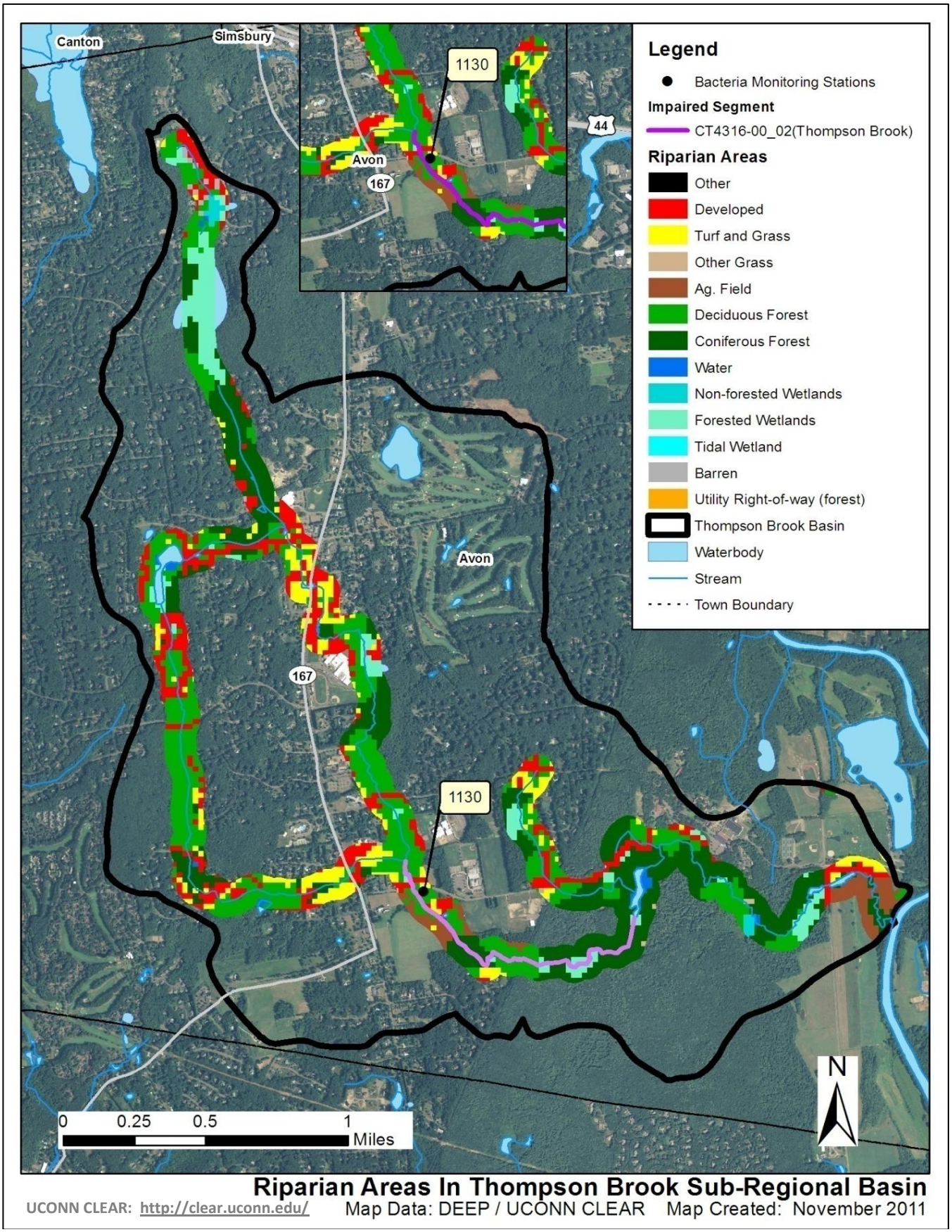
Riparian Buffer Zones

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (http://clear.uconn.edu/), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The majority of the riparian zone for the impaired segment of Thompson Brook is characterized by agriculture and forested land use with portions of turf/grass and developed areas (Figure 10). As previously noted, if not properly treated, runoff from developed areas may contain pollutants such as bacteria and nutrients. Greater developed areas are found along Chidsey Brook, particularly near the Route 167 crossing.

Figure 10: Riparian buffer zone information for the Thompson Brook watershed



CURRENT MANAGEMENT ACTIVITIES

As indicated previously, the Town of Avon is regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each town is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Table 6.

Table 6: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Avon, CT (GSM000044)

Minimum Measure	Avon Annual Report (2011)
Public Outreach and Education	1) Reviewed LID initiatives to minimize the effects of stormwater. 2) Will include Stormwater MS4 information on DPW web page. 3) Working to get Farmington River designated as a National Wild and Scenic River. Provided link on Town website.
Public Involvement and Participation	1) Developed a community clean-up program. 2) Purchased 34 rain barrels and distributed to residents.
Illicit Discharge Detection and Elimination	1) Will develop illicit discharge detection regulations as part of ordinance. 2) Promoted household hazardous waste collection and recycling. 3) Conducted dry weather screening of outfalls during GIS mapping of Town's infrastructure. 4) Will complete GIS mapping of all structures greater than 6 inches in Town's drainage system.
Construction Site Stormwater Runoff Control	1) Annual inspections of construction sites determined the overall compliance rate being achieved by construction operators. 2) Received DEP grant to draft regulations that incorporate LID.
Post Construction Stormwater Management	1) Conducted inspection and maintenance of retention basins and structures.
Pollution Prevention and Good Housekeeping	1) Conducted annual catch basin inspection and cleaning. 2) Conducted annual street sweeping of over 100 miles of roads and parking lots.

RECOMMENDED NEXT STEPS

The Town of Avon has developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of Thompson Brook and have been prioritized below.

1) Identify areas along Thompson Brook to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 38% of the Thompson Brook watershed is considered urban, and the Town of Avon is an MS4 community regulated by the MS4 program. The upper portion of the watershed is developed along Route 167, and bacteria sampling at Station 1130 along the impaired segment exceeded the geometric mean during wet-weather. As such, stormwater runoff is most likely contributing bacteria to the waterbodies.

To identify areas that are contributing bacteria to the impaired segments, the towns should conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segments in the Thompson Brook watershed. Outfalls that show high bacteria concentrations should be prioritized for BMP installation. To treat stormwater runoff, the towns should identify areas along the impaired segment to install BMPs that encourage stormwater to infiltrate into the ground before entering the waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

2) Evaluate municipal education and outreach programs regarding animal waste.

As most of the area upstream of the impaired segment is developed by residential neighborhoods and downstream portions are more heavily forested, any education and outreach program should highlight the importance of managing waste from horses, dogs, and other pets and not feeding waterfowl and wildlife. The town and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of Thompson Brook that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in Thompson Brook and can harm human health and the environment. Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-use areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

3) Ensure there are sufficient buffers on agricultural lands along Thompson Brook.

Agricultural land use represents 6% of the Thompson Brook watershed, and is a concern for water quality, particularly with several agricultural hayfields identified adjacent to the impaired segment. If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place.

4) Develop a system to monitor septic systems.

The majority of the Thompson Brook watershed relies on septic systems. If not already in place, Avon should establish a program to ensure that existing septic systems are properly operated and maintained, and create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of sub-standard systems within a reasonable timeframe can be adopted. The town can also develop a program to assist citizens with the replacement and repair of older and failing systems.

5) Implement a program to evaluate the sanitary sewer system.

A proposed sewer system connection will be installed directly upstream of the impaired segment of Thompson Brook (Figure 6). The town is already mapping storm sewer outfalls greater than 6" diameter and screening for illicit discharges. It is important for Avon to continue to develop a program to evaluate its sanitary sewer and reduce leaks and overflows. This program should include periodic inspections of the sewer line.

6) Continue monitoring of permitted sources.

Bacteria data are currently not available for any of the permitted discharges in the watershed. Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 7 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Thompson Brook watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above

basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 7. Bacteria (e.coli) TMDLs, WLAs, and LAs for Recreational Use

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
A	Non-Stormwater NPDES	0	0	0				0	
	CSOs	0	0	0				0	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with “natural levels” if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 8: Thompson Brook Bacteria Data

Waterbody ID: CT4316-00_02

Characteristics: Freshwater, Class A, Potential Drinking Water Supplies, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **57%**

Single Sample: **62%**

Data: 1998, 2000, 2001, 2008, and 2009 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 1130 on Thompson Brook with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1130	Thompson Road crossing	10/7/1998	31	dry	31
1130	Thompson Road crossing	12/11/1998	31	dry	
1130	Thompson Road crossing	5/15/2000	52	dry	NA
1130	Thompson Road crossing	5/21/2001	63	dry	43
1130	Thompson Road crossing	10/16/2001	30	wet	
1130	Thompson Road crossing	6/2/2008	75	dry	**294* (57%)**
1130	Thompson Road crossing	6/16/2008	51	wet	
1130	Thompson Road crossing	6/30/2008	833	wet	
1130	Thompson Road crossing	7/14/2008	473	wet	
1130	Thompson Road crossing	7/28/2008	959	wet	
1130	Thompson Road crossing	8/11/2008	**1081* (62%)**	wet	
1130	Thompson Road crossing	8/25/2008	121	dry	

Single sample *E. coli* (colonies/100 mL) data from Station 1130 on Thompson Brook with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1130	Thompson Road crossing	6/8/2009	1‡	dry	35
1130	Thompson Road crossing	6/22/2009	341	wet	
1130	Thompson Road crossing	7/6/2009	52	dry	
1130	Thompson Road crossing	7/20/2009	41	dry	
1130	Thompson Road crossing	8/3/2009	73	wet	

Shaded cells indicate an exceedance of water quality criteria

‡Zero value replaced with 1 for inclusion in geomean calculation (http://www.buzzardsbay.org/geomean.htm)

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather geometric mean values for Station 1130 on Thompson Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1130	Thompson Road crossing	1998, 2000, 2001, 2008, 2009	8	9	87	251	34

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gage at the Hartford Bradley International Airport

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